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ABSTRACT

These lesson plans are intended for use in conducting classes on asexual plant reproduction. Presented first are an attention step/problem statement and a series of questions and answers designed to convey general information about asexual plant reproduction/propagation. The following topics are among those discussed: plant reproduction methods, advantages of asexual reproduction, seven types of asexual reproduction, environmental factors needed for taking cuttings, favorable conditions for taking cuttings, processes occurring when a stem cutting is made, and steps in taking successful cuttings. Also provided are the following: a glossary of pertinent scientific terms, four worksheets, answers to the worksheets, two quizzes, answers to the quizzes, eight overhead transparency masters, and lesson plans for conducting learning activities on making a propagation pot, propagating plants by stem cuttings, and checking and caring for cuttings. Each lesson plan includes some or all of the following: objective, list of equipment needed, student activity record sheet, and detailed steps for completing the activity. (MN)

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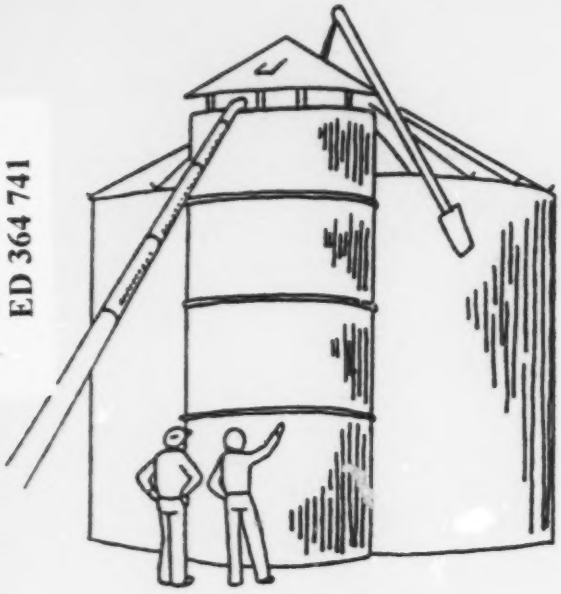

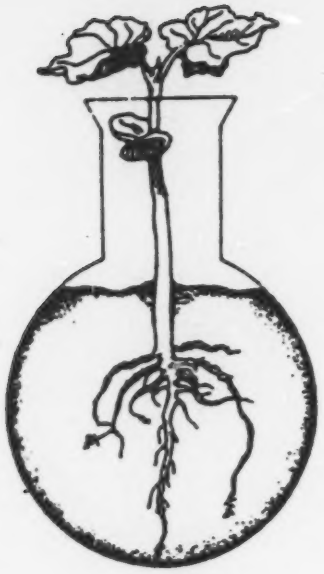

Agricultural Lesson Plans

ASEXUAL PLANT REPRODUCTION

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CE 065 306

Department of
Agricultural Education and Mechanization
Southern Illinois University at Carbondale

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ATTENTION STEP/PROBLEM STATEMENT

A hanging basket of wandering jew (tradescantia) plant was hanging above a window box. A piece of the plant broke off and fell into the window box. Several weeks later, a new wandering jew plant was growing in the window box. How did the piece of wandering jew plant form a new plant?

ANSWER: The plant piece was able to generate roots and develop into a complete plant. This is called asexual reproduction.

General Information about Asexual Reproduction

1. What are the two methods of plant reproduction ?
- Plants are propagated either sexually or asexually. In the sexual reproduction of plants, the offspring is formed from the union of two cells and the offspring has two parents.

2. How many parent plants are needed for asexual reproduction ?
- In asexual reproduction there is only one parent. The offspring is formed by division from a cell or group of cells coming from only one parent, so the offspring has the same genes as the parent.

3. What is the chromosome make up of asexual plant reproduction ?
- In asexual reproduction, new plants have the same chromosomes as the parent plant. The parent plant and offspring are identical. Plants do not vary genetically.

4. What are the Advantages of asexual propagation ?
   1. Offspring is genetically like the parent plant.
   2. Generally larger plants can be obtained more quickly than with sexual propagation.
   3. Seedless plants can be propagated.

5. What are the types of asexual reproduction ?
- Types of asexual reproduction include vegetative reproduction, spores, and cell division in single-celled living things.

6. How does vegetative reproduction occur ?
- In vegetative reproduction, a specialized organ is formed by the parent and becomes detached and generates a new offspring.

7. What are the seven types of vegetative reproduction ?
- Common types of vegetative reproduction and examples of plants that are propagated by these methods are:
   1. runners - strawberry
   2. bulbs - tulips and onions
   3. tuber buds - potatoes
   4. cuttings - foliage plants
   5. grafting - fruit trees
   6. budding - fruit trees
   7. tissue culture - ornamentals
- The best method of propagation depends on plant species.

8. What are plant cuttings ?
- Cuttings are one method of vegetative reproduction. Many plants can be propagated by cuttings.

9. What plant parts can be used for cuttings ?
- The plant parts that can be used in cuttings include: stem, leaves and/or roots.

10. What environmental factors are needed for cuttings ?
- Environmental factors necessary for cuttings to root are proper light levels, favorable moisture supply, optimum temperature, and well drained rooting medium.

11. What conditions are most favorable for taking cuttings ?
- Cuttings should receive bright light, but not excessive light.

- The foliage of a cutting and its medium should not be allowed to dry out.

- Temperature should be approximately 65° F - 75° F for most cuttings that have leaves on them. Hardwood cuttings require cool temperatures, approximately 40° F for rooting.

- Media commonly used for cuttings include: soil, sand, peat moss, shredded sphagnum moss, vermiculite, perlite, and rooting foams or blocks.

12. What is propagation ?
Propagation is the multiplication of plants by both sexual and asexual methods.

13. What occurs when a stem cutting is made ?
When a plant is propagated by a stem cutting, a piece of a stem is cut from the parent plant. There are both living and dead plant cells at the cut surface of the stem cutting. When the stem cutting is removed from the parent plant, the living cells at the cut surface of the stem cutting are injured. The dead conducting cells of the xylem are opened and exposed to air. Xylem is the tissue that moves water up the stem of the plant.

The living cells that have been injured at the cut surface die. This helps seal the wound and prevent the plant from drying out.

A corky material forms and further seals the wound and plugs the xylem. When the xylem is plugged water cannot move up the stem to the plant's leaves.

14. What happens to the living cells close to the cut ?
The living cells close to the cut end of the cutting start dividing and multiplying. Sometimes, the stem may begin to thicken near the cut end of the cutting and form a callus. Not all plants develop a callus before they root.

15. What are auxins ?
The plant needs auxin in order for adventitious roots to form. Adventitious roots are the roots coming from any plant part other than the seedling root and its branches. Auxin is found in many plants but not in all plants. Auxin is a group of plant growth regulators that cause the elongation of roots and shoots when present in low concentrations. The stem cutting can be dipped in auxin if the plant does not have sufficient auxin for rooting.

16. Where does root development begin ?
Some of the living cells that are near the phloem cells begin forming roots cells. Phloem is the tissue that moves food from the leaves of the plant down the stem. The root cells divide and multiply. The root starts getting longer and emerges through the stem. The roots can then continue to grow into a root system.

17. How should cuttings be made ?
Stem cuttings can be taken by cutting through the stem of the plant and removing the cutting from the plant. Cuttings are usually 2 - 4 inches in length. It is important to remember how the stem cutting was positioned on the parent plant. The proximal end of the stem cutting, the end nearest the plant crown, is the end that must be stuck in the medium for the stem cutting to root. The distal end of the plant is the end of the plant nearest the shoot tip. The distal end of the plant will not root if it is stuck into the medium. A rooting compound, a substance applied to a cutting to aid in rooting, can be applied to the proximal end of the cutting before sticking into the medium.

18. What other steps are essential for cuttings to be successful?
The lower leaves of a stem cutting are often removed before sticking the cutting in the medium. One or two of the stem cutting's nodes, the point on the stem where the leaves are attached, should be stuck into the medium. A label, pencil, dowel, or other instrument is used to make one inch holes in the medium where the cuttings will be stuck. The holes must be made before the cuttings are stuck to prevent injury to the cuttings. Stem cuttings are stuck into the holes and the medium is firmed around the stem of the cutting.

GLOSSARY OF SCIENTIFIC TERMS:

Adventitious roots -	roots coming from any plant part other than the seedling root and its branches.
Asexual Reproduction -	reproduction in which no sex cells are involved.
Auxin -	a group of plant growth regulators that causes the elongation of roots and shoots when present in low concentrations.

Callus -	a thickening of the stem before roots appear in some plant species.
Cutting -	a portion of a plant that has been cut from parent plant and will be used to produce a new offspring.
Distal -	end of plant nearest the shoot tip.
Media -	material in which a plant is grown (ex. soil).
Node -	point on the stem where one or more leaves are attached.
Phloem -	the conductive tissue in a plant that carries sugars and minerals from the leaves to other parts of a plant.
Plant Species -	distinct kind of plant.
Propagation -	multiplication of plants by both sexual and asexual methods.
Proximal -	end of plant nearest the crown of the plant.
Rooting Compound -	any substance that is applied to a cutting to aid in rooting.
Spores -	a single cell that is able to grow into a new organism (ex. mushrooms).
Vegetative Reproduction -	form of asexual reproduction in which specialized organs formed by the parent become detached and generate a new offspring.
Xylem -	the conductive tissue in a plant that carries water up the stem from the roots to the leaves.

Work Sheet A

Directions:

Complete the following questions.

1. Plants that have been reproduced sexually have _____ parent(s), while plants that have been reproduced asexually have _____ parent(s).

2. Plants that are propagated asexually have the _____ chromosomes as the parent plant.

3. The three types of asexual reproduction are:
   a. _____
   b. _____
   c. _____

4. In _____,a specialized organ is formed by the parent and becomes detached and generates a new offspring.

5. Four common types of vegetative reproduction are:

   a. _____
   b. _____
   c. _____
   d. _____

6. Three plant parts that can be used in cuttings are:

   a. _____
   b. _____
   c. _____

7. Four environmental factors necessary for cuttings to root are:
   a. _____
   b. _____
   c. _____
   d. _____

WORK SHEET B

Directions:

The answers to the following fill-in-the blank questions are terms which have something to do with asexual reproduction. Choose the term from the word list below that best answers each question. Each term may be only used once.

Word List:

adventitious roots	**phloem**
asexual reproduction	**plant species**
auxin	**propagation**
callus	**proximal**
cutting	**rooting compound**
distal	**spores**
media	**vegetative reproduction**
node	**xylem**

Fill-in-the-blank:

1. The point on the stem where one or more leaves are attached is called a _____.

2. _____ is a type of reproduction in which no sex cells are involved and the offspring has only one parent.

3. A _____ is a portion of a plant that has been cut from the parent plant and will be used to produce a new offspring.

4. _____ is the multiplication of plants by either sexual or asexual methods.

5. A _____ is any substance that is applied to a cutting to aid in rooting.

6. The roots coming from any plant part other than the seedling root are called _____.

7. Sometimes on a cutting a _____, or a thickening of the stem appears before roots appear.

8. _____ are a type of asexual reproduction occurring in mushrooms and ferns where a single cell is able to grow into a new organism.

9. _____ is the conductive tissue in a plant that carries sugars and minerals from the leaves to other parts of a plant.

10. The _____end of plant is the end nearest the shoot tip.

11. _____are a group of plant growth regulators that can cause the elongation of roots and shoots on cuttings when present in low concentrations.

12. In _____, specialized organs formed by the parent become detached and generate a new offspring.

13. Plants may be grown in many different types of _____,including soil, sand and soilless mix.

14. The _____end of plant is the end nearest the crown of the plant.

15. _____are distinct kinds of plants.

16. _____ is the conductive tissue in a plant that carries water up the stem from the roots to the leaves.

Work Sheet C

Directions:

Answer the following questions with True or False.

_____1. The living cells that have been injured at the cut surface of a stem cutting die.

_____2. The wound on a stem cutting is sealed by dead cells and a corky material.

_____3. After a stem cutting has been taken, the phloem cells become plugged and water is unable to move up the phloem tissue to the plant's leaves.

_____4. A callus must form on the end of a stem cutting in order for roots to form.

_____5. Auxin is needed for adventitious roots to form on stem cuttings.

_____6. Auxin cannot be applied to a stem cutting to aid in rooting.

_____7. Root cells begin forming near phloem cells at the base of a stem cutting.

WORK SHEET D:
STUDENT REVIEW

1. Define asexual reproduction.

2. List 3 examples of asexual reproduction.

3. Name 4 types of vegetative reproduction.

4. What plant parts can be used for cuttings?

5. What factors are necessary for favorable rooting of cuttings?

6. How is the cut end of a cutting sealed after the cutting is taken?

7. Why is auxin important to stem cuttings?

8. Where do roots begin to form on stem cuttings?

9. Describe the procedure used in taking cuttings.

10. How do you stick stem cuttings properly?

11. How should cuttings be removed from the medium?

Work Sheet A

Directions:

Complete the following questions.

1. Plants that have been reproduced sexually have *2* parent(s), while plants that have been reproduced asexually have *1* parent(s).

2. Plants that are propagated asexually have the *same* chromosomes as the parent plant.

3. The three types of asexual reproduction are:
   a. *Cell Division in single-celled living things*
   b. *Spores*
   c. *Vegetative Reproduction*

4. In *Vegetative Reproduction*, a specialized organ is formed by the parent and becomes detached and generates a new offspring.

5. Four common types of vegetative reproduction are:

   a. *Students may answer with any 4 of the following:*
   b. *runners, bulbs, tuber buds,*
   c. *cuttings, grafting,*
   d. *budding, tissue culture*

6. Three plant parts that can be used in cuttings are:

   a. *stem*
   b. *leaves*
   c. *roots*

7. Four environmental factors necessary for cuttings to root are:
   a. *proper light levels (bright but not excessive light)*
   b. *favorable moisture supply (cuttings should not dry out)*
   c. *optimum temperatures (65°F - 75°F)*
   d. *well-drained rooting medium*

WORK SHEET B

Directions:

The answers to the following fill-in-the blank questions are terms which have something to do with asexual reproduction. Choose the term from the word list below that best answers each question. Each term may be only used once.

Word List:

adventitious roots	**phloem**
asexual reproduction	**plant species**
auxin	**propagation**
callus	**proximal**
cutting	**rooting compound**
distal	**spores**
media	**vegetative reproduction**
node	**xylem**

Fill-in-the-blank:

1. The point on the stem where one or more leaves are attached is called a ___*node*___.

2. ___*Asexual reproduction*___ is a type of reproduction in which no sex cells are involved and the offspring has only one parent.

3. A ___*cutting*___ is a portion of a plant that has been cut from the parent plant and will be used to produce a new offspring.

4. ___*Propagation*___ is the multiplication of plants by either sexual or asexual methods.

5. A ___*rooting compound*___ is any substance that is applied to a cutting to aid in rooting.

6. The roots coming from any plant part other than the seedling root are called ___*adventitious roots*___.

7. Sometimes on a cutting a ___*callus*___, or a thickening of the stem appears before roots appear.

8. ___*Spores*___ are a type of asexual reproduction occurring in mushrooms and ferns where a single cell is able to grow into a new organism.

9. ___*Phloem*___ is the conductive tissue in a plant that carries sugars and minerals from the leaves to other parts of a plant.

10. The ___*distal*___end of plant is the end nearest the shoot tip.

11. ___*Auxins*___are a group of plant growth regulators that can cause the elongation of roots and shoots on cuttings when present in low concentrations.

12. In ___*vegetative reproduction*___, specialized organs formed by the parent become detached and generate a new offspring.

13. Plants may be grown in many different types of ___*media*___,including soil, sand and soilless mix.

14. The ___*proximal*___end of plant is the end nearest the crown of the plant.

15. ___*Plant Species*___are distinct kinds of plants.

16. ___*Xylem*___ is the conductive tissue in a plant that carries water up the stem from the roots to the leaves.

Work Sheet C

Directions:

Answer the following questions with True or False.

True 1. The living cells that have been injured at the cut surface of a stem cutting die.

True 2. The wound on a stem cutting is sealed by dead cells and a corky material.

False 3. After a stem cutting has been taken, the phloem cells become plugged and water is unable to move up the phloem tissue to the plant's leaves.

False 4. A callus must form on the end of a stem cutting in order for roots to form.

True 5. Auxin is needed for adventitious roots to form on stem cuttings.

False 6. Auxin cannot be applied to a stem cutting to aid in rooting.

True 7. Root cells begin forming near phloem cells at the base of a stem cutting.

WORK SHEET D:
STUDENT REVIEW

1. Define asexual reproduction.
   Asexual Reproduction is reproduction in which no sex cells are involved.

2. List 3 examples of asexual reproduction.
   Vegetative Reproduction, Spores, and Cell division in single-celled living things are three examples of asexual reproduction.

3. Name 4 types of vegetative reproduction.
   Students may list any 4 of the following: Runners, Bulbs, Tuber Buds, Cuttings, Grafting, Budding, or Tissue Culture.

4. What plant parts can be used for cuttings?
   Stem, leaves, and roots can be used as cuttings.

5. What factors are necessary for favorable rooting of cuttings?
   Cuttings need bright light, favorable moisture supply, optimum temperatures (65° F to 75° F), and well drained rooting medium.

6. How is the cut end of a cutting sealed after the cutting is taken?
   The living cells at the cut surface die and a corky material forms and further seals the wound.

7. Why is auxin important to stem cuttings?
   Auxin is needed in order for adventitious roots to form.

8. Where do roots begin to form on stem cuttings?
   Root cells begin forming near the phloem tissue.

9. Describe the procedure used in taking cuttings.
   A cutting should be removed from the parent plant with a sharp, clean knife.

10. How do you stick stem cuttings properly?
    Make a one inch deep hole in the medium with a label or other instrument. Stick stem cuttings in hole. Firm medium around the stem.

11. How should cuttings be removed from the medium?

    Cuttings should be lifted out of the medium by placing a label or trowel under the cutting and lifting them out.

Quiz1

A. **Matching:**

Match the best definition with each term.

_____ 1. Spores

_____ 2. Asexual Reproduction

_____ 3. Vegetative Reproduction

_____ 4. Cuttings

a. form of asexual reproduction in which specialized organs formed by the parent become detached and generate a new offspring

b. a single cell that is able to grow into a new organism

c. plant stem, leaves, or roots that have been cut from parent plant and will be used to produce a new offspring

d. reproduction in which no sex cells are involved

B. **True or False:**

5. Cuttings need well-drained medium, cold temperatures, favorable moisture supply, and full sun to root.

_____ 6. Dead cells and a corky material seals the wound on the cut end of a stem cutting.

C. **Fill-in-the-blank:**

7. A stem cutting needs _____ in order for adventitious roots to form.

8. One common method of vegetative reproduction is _____.

9. In order for a stem cutting to root, some of the living cells near the _____ **cells must begin forming root cells.**

D. **Short Answer:**

10. Name 3 plant parts that can be used for cuttings.

Quiz 2

A. **Matching:**

_____ 1. media

_____ 2. node

_____ 3. auxin

a. group of plant growth regulators that cause the elongation of roots and shoots when present in low concentrations

b. material in which a plant is grown

c. point on the stem where one or more leaves are attached

B. **True or False:**

_____ 4. Check cuttings for rooting once a week by grasping the cuttings with your fingers and pulling the cuttings from the medium.

_____ 5. A label or other instrument should be used to make one inch holes in the medium before cuttings are stuck.

_____ 6. When using stem cuttings in experiments, use cuttings with the same amount of foliage, and are the same length and same diameter to accurately compare treatments.

C. **Fill-in-the-blank:**

7. Stem cuttings should be approximately _____ inches in length.

8. Additional auxin may be applied to a cutting by applying a _____, such as IBA (indolebutyric acid).

9. A _____ can be used to provide more humid conditions to cuttings at home or school.

D. **Short Answer:**

10. Explain the procedure for applying IBA to cuttings.

Quiz 1

A. Matching:

Match the best definition with each term.

b 1. Spores

d 2. Asexual Reproduction

a 3. Vegetative Reproduction

c 4. Cuttings

a. form of asexual reproduction in which specialized organs formed by the parent become detached and generate a new offspring
b. a single cell that is able to grow into a new organism
c. plant stem, leaves, or roots that have been cut from parent plant and will be used to produce a new offspring
d. reproduction in which no sex cells are involved

B. True or False:

False 5. Cuttings need well-drained medium, cold temperatures, favorable moisture supply, and full sun to root.

True 6. Dead cells and a corky material seals the wound on the cut end of a stem cutting.

C. Fill-in-the-blank:

7. A stem cutting needs *auxin* in order for adventitious roots to form.

8. One common method of vegetative reproduction is *runners, bulbs, tuber buds, cuttings, grafting, budding, or tissue culture.*.

9. In order for a stem cutting to root, some of the living cells near the *phloem* **cells must begin forming root cells.**

D. Short Answer:

10. Name 3 plant parts that can be used for cuttings.
Roots, Leaves, and Stem

Quiz 2

A. Matching:

_b_ 1. media

_c_ 2. node

_a_ 3. auxin

a. group of plant growth regulators that cause the elongation of roots and shoots when present in low concentrations
b. material in which a plant is grown
c. point on the stem where one or more leaves are attached

B. True or False:

False 4. Check cuttings for rooting once a week by grasping the cuttings with your fingers and pulling the cuttings from the medium.

True 5. A label or other instrument should be used to make one inch holes in the medium before cuttings are stuck.

True 6. When using stem cuttings in experiments, use cuttings with the same amount of foliage, and are the same length and same diameter to accurately compare treatments.

C. Fill-in-the-blank:

7. Stem cuttings should be approximately *2 - 4* inches in length.

8. Additional auxin may be applied to a cutting by applying a *rooting compound*, such as IBA (indolebutyric acid).

9. A *propagation pot* can be used to provide more humid conditions to cuttings at home or school.

D. Short Answer:

10. Explain the procedure for applying IBA to cuttings.

Dip the cut end of the proximal end into rooting compound. Tap excess rooting compound from the cutting.

Teaching Note: ***Demonstrate taking stem cuttings, applying rooting compound, and sticking stem cuttings to the students.***

The following plant list includes some of the herbaceous plants that can be propagated by stem cuttings.

chrysanthemums	*carnations*
coleus	*pilea*
ivy	*wandering jew*
geranium	*impatiens*
philodendron	*pothos*
begonia	*poinsettia*

MAKING A PROPAGATION POT

a. **Purpose:** to learn how to make a propagation pot.
The humidity level in homes and schools is too dry for most cuttings to survive. Commercially, cuttings are stuck in media and are placed under a mist system or fog system to root. A propagation pot is one way to provide cuttings with high humidity in the classroom or home.

b. **What Each Student Needs:**

One Plastic Pot (6 inch)
One Clay Pot (3 inch)
One small cork
Vermiculite (enough to fill the 6 inch pot)
Paper Towel
Water-Proof Marker

c. **Here's How:**

1. Get a 6" plastic pot. Write your name on pot with water-proof marker.
2. Put a paper towel in the bottom of the pot to keep vermiculite from falling out of the drainage holes.
3. Fill the pot to an inch from the top with vermiculite.
4. Get one 3" clay pot.
5. Plug the drainage hole in the 3 inch pot with a cork.
6. Insert the clay pot (right side up) into the vermiculite. (The rim of the clay pot should be above the vermiculite).
7. Water the vermiculite thoroughly.
8. Fill the clay pot with water.
The propagation pot is now ready to use.

PROPAGATING PLANTS BY STEM CUTTINGS

a. **Purpose:** to learn how to take stem cuttings.
to learn how to stick stem cuttings.

b. **What Each Student Needs:**
herbaceous plant
knife
labels
paper towel
permanent marker
rooting compound
propagation pot

c. **Here's How:**

1. Use the stock plant that your teacher has assigned.

2. Examine the plant and locate stems where cuttings can be taken.

Note: ***Knives should be disinfected before each use to prevent the spread of disease from one plant to another. To disinfect knives, dip them into a bleach solution made at the rate of 1 part of household bleach to 4 parts water. Other disinfectants may be substituted.***

3. Remove 6 uniform stem cuttings from the stock plant by making a clean cut through the stem with a disinfected knife. Cuttings should be the same length, same stem diameter, and have the same amount of foliage to achieve accurate comparison of treatments.

Note: ***Do not allow stem cuttings to dry out before sticking them into the medium.***

4. Remember which ends of the stem cuttings are the proximal and distal ends.

Note: ***To prevent the contamination of the entire jar of IBA, pour a small amount of IBA onto a paper plate or other container. The students can then dip their cuttings into the IBA on the paper plate. At the completion of the activity, the paper plate and any remaining IBA should be discarded in the trash. IT SHOULD NOT BE PUT BACK INTO THE JAR OF IBA.***

5. Dip the cut surface of the proximal ends of three cuttings into rooting compound. The rooting compound you are using contains a synthetic auxin called IBA (indolebutyric acid) and talc. Make sure you tap any excess rooting compound from the cutting. Too much auxin can have an herbicide effect on the cutting and cause it too die.

6. Remove bottom set of leaves on cuttings.

Note: ***Cuttings should be stuck in preformed holes in the medium. If cuttings are directly stuck into the medium, injury to the cuttings may result.***

7. Make six holes about one-inch deep into the vermiculite in the propagation pot with a label.

8. Stick proximal end of the treated cuttings into the holes and firm vermiculite around cutting. Try to have one of the plant's nodes in the vermiculite.

9. Write your name, date, treatment, and name of plant species on label with pencil and insert it into vermiculite near the treated cuttings.

10. Stick proximal end of the untreated cuttings into the holes and firm vermiculite around cutting. Try to have one of the plant's nodes in the vermiculite.

11. Write your name, date, treatment, and name of plant species on label with pencil and insert into vermiculite near the untreated cuttings.

12. Place propagation pot with the cuttings in a warm, bright place.

13. Clean up your work area.

STUDENT ACTIVITY - RECORD SHEET

A. Observations:

Check cuttings at least once a week and note any roots forming. Record observations and make a sketch of the root formation each week.

	Control Group of Cuttings	**Cuttings With IBA Treatment**
Week 1		
Week 2		
Week 3		

Predictions:

1. Which group of cuttings will root the quickest?

2. Why do you think this group will root the quickest?

3. What environmental conditions might affect the rooting of the cuttings?

C. Conclusions:

1. Which group of cuttings rooted the quickest?

2. Why do you think this group rooted the quickest?

3. What environmental conditions affected the rooting of the cuttings?

CHECKING AND CARING FOR STEM CUTTINGS

a. **Purpose:** to learn how to check and care for stem cuttings.

b. **What Each Student Needs:**

propagation pot with stem cuttings
water
label

c. **Here's How:**

1. Keep the clay pot inside the propagation pot filled with water. Do not water the vermiculite after it has initially been moistened.

2. Check cuttings at least once a week to see if they have rooted by using a label to lift cuttings from vermiculite. Make sure you place label under the cutting and gently lift (like serving a piece of pie). Do not check cuttings by pulling out the cutting with your fingers because you could tear roots off the cutting.

3. Compare the rooting speed of the treatments. Record your observations on the Student Activity - 2 Record Sheet.

4. Cuttings can be removed once they have developed an adequate root system.

5. To remove cuttings once they have rooted:
    a. Remove cuttings from propagation pot by lifting them out with a label.
    b. Shake off excess vermiculite from cuttings.

OH1

SEVEN COMMON TYPES OF VEGETATIVE REPRODUCTION

1. RUNNERS

2. BULBS

3. TUBER BUDS

4. CUTTINGS

5. GRAFTING

6. BUDDING

7. TISSUE CULTURE

OH2

PLANT PARTS USED FOR CUTTINGS:

STEM

LEAVES

ROOTS

ENVIRONMENTAL FACTORS

BRIGHT LIGHT

FAVORABLE MOISTURE

OPTIMUM TEMPERATURE

WELL-DRAINED MEDIUM

OH4

CALLUS:

1. IS A THICKENING OF THE STEM.

2. SOMETIMES FORMS NEAR THE CUT END OF THE STEM CUTTING.

3. IS NOT NECESSARY FOR ROOTING.

OH5

ADVENTITIOUS ROOTS:

1. ORIGINATE NEAR THE PHLOEM CELLS ON THE PROXIMAL END OF THE CUTTING.

2. EMERGE THROUGH THE STEM AFTER ROOT CELLS MULTIPLY AND DIVIDE.

3. NEED AUXIN TO FORM.

OH6

HOW TO TAKE A STEM CUTTING

1. MAKE A CLEAN CUT THROUGH THE STEM.

2. USE A CLEAN KNIFE.

3. CUTTINGS SHOULD BE 2 - 4 INCHES IN LENGTH.

4. REMOVE LOWER LEAVES.

OH7

A COMPLETED LABEL:

1. NEEDS TO BE WRITTEN IN PENCIL.

2. SHOULD INCLUDE THE:

    a. STUDENT'S NAME.

    b. THE DATE.

    c. ANY SPECIAL TREATMENTS.

    d. NAME OF THE PLANT.

OH8

CHECKING CUTTINGS

CHECK WEEKLY.

PLACE LABEL UNDER ROOTS AND LIFT CUTTINGS TO CHECK.

STICK CUTTINGS BACK IN MEDIUM UNTIL THEY ROOT.